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Fourier Analysis of Fast Vacuum Arc Parameters

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Vacuum arcs are known for their noisy character: all parameters show more-or-less rapid fluctuations. This is of particular concern to those who would like to utilize the exceptional properties of the vacuum arc plasma in ion sources other devices. Among these properties are the very high degree of ionization and the presence of multiply ionized species. The rapid fluctuations are known to be ultimately caused by the explosive nature of the perpetual spot ignition and plasma production. In this contribution, we present a systematic application of Fast Fourier Transform to fluctuating parameters such as voltage and current. New possibilities have arisen with the advent of fast digital oscilloscopes and relatively low cost computation of large amounts of data. We show that most fluctuations indicate fractal character, i.e. the spectral power scales with a power law in log-log presentation. In the high frequency region (typically 50 MHz and faster), the fractal behavior seems to be cut off, which might be associated with approaching the region of individual explosive processes, also known as ectons.

List of Key Words: Vacuum Arcs, Cathode Spots, Fourier Analysis, Fractals, Ectons

Proposed Session: B1

Preferred Presentation: Oral, Speaker: A. Anders

Equipment: computer projector